
तार और बिटुमिनी सामग्री
की परीक्षण विधियाँ — आपेक्षिक गुरुत्व
ज्ञात करना
(दूसरा पुनरीक्षण)

Methods for Testing Tar and
Bituminous Materials —
Determination Of Specific Gravity
(Second Revision)

ICS 75.140

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Bitumen, Tar and Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Product Division Council.

This standard was originally published in 1958 as 'Methods for testing tar and bituminous materials — Determination of Specific gravity and subsequently revised in 1978. 'Methods for testing tar and bituminous materials' was originally published as series of 22 standards in the form of a booklet, as listed below:

<i>IS No.</i>	<i>Title</i>
1201 : 2004	Sampling
1202 : 1978	Determination of specific gravity
1203 : 1978	Determination of penetration
1204 : 1978	Determination of residue of specified penetration
1205 : 1978	Determination of softening point
1206 (Part 1) : 1978	Determination of viscosity: Part 1 Industrial viscosity
1206 (Part 2) : 1978	Determination of viscosity: Part 2 Absolute viscosity
1206 (Part 3) : 1978	Determination of viscosity: Part 3 Kinematic viscosity
1207 : 1978	Determination of equiviscous temperature (EVT)
1208 : 1978	Determination of ductility
1209 : 1978	Determination of flash point and fire point
1210 : 1978	Float test
1211 : 1978	Determination of water content dean and stark method
1212 : 1978	Determination of loss on heating
1213 : 1978	Distillation test
1214 : 1978	Determination of matter insoluble in benzene (WITHDRAWN due to toxic nature of benzene)
1215 : 1978	Determination of matter insoluble in toluene
1216 : 1978	Determination of solubility in carbon disulphide trichloroethylene
1217 : 1978	Determination of mineral matter ash
1218 : 1978	Determination of phenols
1219 : 1978	Determination of naphthalene
1220 : 1978	Determination of volatile matter content

However, the Committee responsible for the formulation of standards in the field of bitumen, tar and related products decided to publish these Indian standards separately for each test so as to make it user friendly.

Accordingly, second revision of the standard, was taken up to formulate individual standard on determination of specific gravity. In this revision, the term-specific gravity term has been redefined as the ratio of the mass of a given volume of the substance to the mass of an equal volume of water, at the same temperature. Formula for calculation of density, based on specific gravity measurements has also been provided.

The Composition of the Committee responsible for formulation of this standard is given at Annex A.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

METHODS FOR TESTING TAR AND BITUMINOUS MATERIALS — DETERMINATION OF SPECIFIC GRAVITY

(*Second Revision*)

1 SCOPE

This standard covers the methods for the determination of specific gravity of asphalt, bitumen, bituminous products, road tar, coal tar, coal tar pitch, creosote and anthracene oil.

2 TERMINOLOGY

For the purpose of this standard, the following definition and those given in IS 334 : 1965 shall apply.

2.1 Specific Gravity — The ratio of the mass of a given volume of the substance to the mass of an equal volume of water, at the same temperature.

2.1.1 The specific gravity of bitumens, fluxed native asphalt, road tars, coal tar pitch and blown bitumen shall be determined at 25 °C and that of creosote oil and anthracene oil at 38 °C and shall be expressed as specific gravity 25 °C/25 °C or 38 °C/38 °C.

3 METHOD A (PYKNOMETER METHOD)

3.1 This method covers the determination of specific gravity for semisolid bitumen road tars and creosote and anthracene oil.

3.2 Apparatus

Specific gravity bottles of 50 ml capacity shall be used. One of the two types of specific gravity bottles, namely (a) the ordinary capillary type specific gravity bottle with a neck of 6 mm diameter (*see* Fig. 1A) and (b) the wide-mouthed capillary type specific gravity bottle (*see* Fig. 1B) with a neck of 25 mm diameter shall be used.

The stopper shall be provided with a bore 1.0 to 2.0 mm in diameter centrally located in reference to the vertical axis. The top surface of the stopper shall be smooth and substantially plain and the lower surface shall be concave in order to allow all air to escape through the bore. The height of the concave section shall be 4.0 to 6.0 mm at the centre.

3.2.1 The ordinary specific gravity bottle shall be used for materials which remain absolutely fluid at 25 °C while the wide mouth capillary type shall be used for materials which remain semisolid at 25 °C.

3.2.2 Constant Temperature Bath — A water bath having a depth greater than that of Pyknometer capable of being maintained within 0.2 °C of the desired temperature.



FIG. 1A ORDINARY CAPILLARY TYPE
SPECIFIC GRAVITY BOTTLE

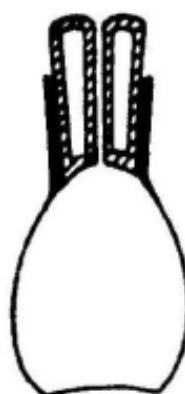


FIG. 1B WIDE-MOUTHED CAPILLARY TYPE
SPECIFIED GRAVITY BOTTLE

3.2.3 Bath Thermometer — It shall conform to the following requirements:

<i>Characteristic</i>	<i>Requirement</i>
Range	0 to 44 °C
Least Count	0.1 °C

3.3 Procedure

Clean, dry and weigh the specific gravity bottle together with the stopper (a). Fill it with freshly boiled and cooled distilled water and insert the stopper firmly. Keep the bottle up to its neck for not less than half an hour in a beaker of distilled water maintained at a temperature of 27.0 ± 0.1 °C or any other temperature at which specific gravity is to be determined; wipe all surplus moisture from the surface with a clean, dry cloth and weigh again (b). After weighing the bottle and water together (b) the bottle shall be dried again.

3.3.1 In the case of solids and semisolids, bring a small amount of the material to a fluid condition by gentle application of heat, care being taken to prevent loss by evaporation. When the material is sufficiently fluid, pour a quantity into the clean, dry specific gravity bottle mentioned at 3.3 to fill at least half. Slightly warm the bottle before filling. Keep the material away from touching the sides above the final level of the bottle and avoid the inclusion of air bubbles. The use of a small funnel will prevent contamination of the neck of the bottle. To permit escape of entangled air bubbles, allow the partly filled bottle to stand for half an hour at a temperature between 60-70 °C, then cool to the specified temperature and weigh with the stopper (c).

3.3.2 Fill the specific gravity bottle containing the bituminous binders with freshly boiled distilled water placing the stopper loosely in the specific gravity bottle. Do not allow any air bubble to remain in the specific gravity bottle. Place the specific gravity bottle in the water bath and press the stopper firmly in place. Allow the specific gravity bottle to remain in the water bath for a period of not less than 30 min. Remove the specific gravity bottle from the water bath, wipe all surplus moisture from the surface with a clean dry cloth and weigh it along with the stopper.

3.3.3 In the case of liquids such as creosote and anthracene oil, fill the bottle up to the brim and insert the stopper firmly. Keep the filled bottle for not less than half an hour in a beaker of distilled water maintained at a temperature of 27.0 ± 0.1 °C, remove the bottle from the beaker, wipe all surplus water from the surface with a clean, dry cloth and weigh again.

3.4 Calculation

Calculate the specific gravity of the material as follows:

- a) Specific gravity (solids and semisolids) =

$$\frac{c - a}{(b - a) - (d - c)}$$

- b) Specific gravity (Liquids) = $\frac{e - a}{b - a}$

where

- a = mass of the specific gravity bottle,
 b = mass of the specific gravity bottle filled with distilled water,
 c = mass of the specific gravity bottle about half filled with the material,
 d = mass of the specific gravity bottle about half filled with the material and the rest with distilled water, and
 e = mass of the specific gravity bottle completely filled with the material.

- c) Calculate density to the nearest 0.001 as follows

$$\text{Density} = \text{Specific gravity} \times W_T$$

Here, W_T is the density of water at the test temperature.

Use density of water at 25 °C as 997.0 kg/m³ and at 15.6 °C as 999.0 kg/m³ and at 38 °C as 993.1 kg/m³

3.5 Precision

With samples which are neither very volatile nor very viscous and using a pycnometer of at least 25 ml capacity, the results of duplicate tests should not differ by the following:

<i>Repeatability</i>	<i>Reproducibility</i>
0.002	0.005

3.6 Precautions

When making the specific gravity determination, it is important that:

- only freshly boiled and cooled distilled water shall be used;
- at no time of weighing shall the temperature of the apparatus be allowed to exceed the specified temperature;
- precautions shall be taken to prevent expansion and over-flow of the contents resulting from the heat of the hand when wiping the surface of the apparatus;
- all air bubbles shall be eliminated in filling the apparatus and inserting the stopper;

- e) weighing shall be done quickly after filling the apparatus and shall be accurate to 0.1 mg; and
- f) to prevent breakage of the apparatus when cleaning after a determination has been made upon a very viscous or semisolid material, it is advisable to warm it in an oven at a temperature not above 100 °C, until most of the material is poured out and then to swab it with a piece of soft cloth or cotton waste. When cool, it may be finally rinsed with carbon disulphide, benzol or other solvent and wiped clean.

4 METHOD B (BALANCE METHOD)

4.1 This test method is intended for the determination of the specific gravity of semi-solid and solid bituminous materials by weighing in air and in water.

4.2 Apparatus

4.2.1 Balance Analytical

4.2.2 Thermometer — As given in Method A.

4.2.3 Balance Straddle — A pan straddle of convenient size to support a beaker and permit determination of the weight of the specimen in water (see Fig. 2).

4.2.4 Thread — A length of fine, waxed, silk thread.

4.2.5 Brass Moulds — Cubical, measuring approximately 20 mm on each edge.

4.3 Test Specimen

The test specimen shall be a cube of the material measuring approximately 20 mm on each edge. Prepare the specimen by melting a small sample of the material by gentle application of heat, taking care to prevent loss by evaporation, and pouring the material when sufficiently fluid into a 20 mm brass cubical mould that has been treated with a 1 : 1 mixture of glycerine and dextrin and placed on a brass plate previously so

treated. Take precautions to prevent the inclusion of air bubbles. The hot material should be slightly more than that required to fill the mould, and when cool, the excess may be cut off with a hot spatula. Remove the specimen from the mould when cooled to room temperature.

4.4 Procedure

Tare the balance first with a piece of fine waxed silk thread sufficiently long to reach from the hook on one of the pan supports to the rest. Attach the test specimen to the thread. So as to be suspended about 25 mm above the straddle from the hook on the pan support, and weigh to the nearest 0.1 mg. Weigh the specimen, still suspended by thread, and completely immersed in freshly boiled and cooled distilled water at 27.0 ± 0.1 °C, to the nearest 0.1 mg, adhering air bubbles being first removed with a fine wire.

4.5 Calculation

Calculate the specific gravity of the material as follows:

$$\text{Specific gravity} = \frac{a}{a - b}$$

where

a = mass of the dry specimen, and

b = mass of the specimen when immersed in distilled water.

4.6 Report

Report the specific gravity to the nearest 0.001 at 25 °C/ 25 °C. The buoyancy/correction in this case is negligible.

4.7 Precision

The duplicate results shall not differ by more than the following:

Size of Sample	Repeatability	Reproducibility
5 g or larger	0.005	0.007

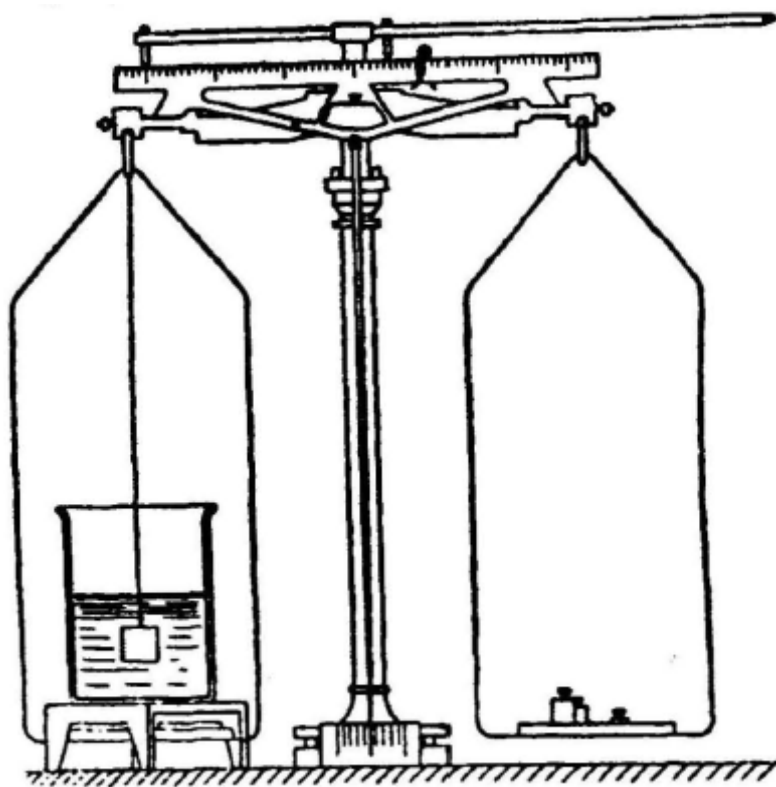


FIG. 2 ANALYTICAL BALANCE EQUIPMENT WITH PAN STRADDLE

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Bitumen, Tar and Related Products Sectional Committee, PCD 06

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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